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(71) Sökande Applicant (s) *Net Insight AB, Stockholm SE*

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Emma Johnsson

Emma Johnsson

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PATENT- OCH REGISTRERINGSVERKET
SWEDEN
Postadress/Adress Box 5055 S-102 42 STOCKHOLM
Telefon/Phone +46 8 782 25 00 Vx 08-782 25 00
Telex 17978 PATOREG S
Telefax +46 8 666 02 86 08-666 02 86

METHODS AND ARRANGEMENT FOR ESTABLISHING COMMUNICATION CHANNELS IN A DTM NETWORK

Technical field of invention

The present invention refers to methods and an arrangement for establishing communication channels in a DTM network.

Background of the Invention

In recent years, the need for network solutions providing quality of service in high bandwidth applications has evolved as a result of the increasing demand for transfer of real-time speech, video and multimedia over networks such as the Internet.

The use of circuit switched networks, which have the inherent property of providing each host with a guaranteed bandwidth, has been found to provide may advantageous features in this context.

A new circuit switched network solution that has received much interest over the last few years is known as DTM (Dynamic synchronous Transfer Mode). In a DTM network, circuit switched channels may be dynamically established, modified, and terminated based upon changes in user transfer capacity requirements.

However, a drawback with circuit switched network solutions such as DTM is that dynamic management of channels requires signaling overhead. As the number of dynamically managed channels increases, as well as the number of nodes participating in the channel management, the signaling overhead will grow to imply a serious obstacle to the use of the dynamic aspects of the DTM technology.

In view of the above, an object of the invention is to provide a solution which decreases the demand for control signaling within circuit switched networks of the kind mentioned in the introduction, especially within a DTM network.

Summary of the Invention

The above mentioned and other objects are achieved by the invention as defined in the accompanying claims.

According to a first aspect of the invention, there is provided a method for establishing communication channels in a DTM network, said method comprising the steps of: establishing a DTM channel from a first node to a second node via one or more intermediate nodes; and establishing a set of DTM channels within said a DTM channel.

According to a second aspect of the invention, there is provided an arrangement for establishing communication channels in a DTM network, said arrangement comprising: a first node; a second node; means for establishing a DTM channel from said first node to said second node, wherein said DTM channel is established via one or more intermediate nodes; and means for establishing a set of DTM channels within said a DTM channel.

The invention is thus based upon the idea of treating a plurality of DTM channels, herein occasionally referred to as DTM subchannels, as constituents of single DTM channel, herein occasionally referred to as a DTM main channel or a DTM "tunnel". The invention thereby makes it possible to manage, alter, modify, etc., the distribution of time slots among DTM subchannels without necessarily having to affect the management of the DTM main channel, the size of the DTM main channel, or the allocation of time slots to the DTM main channel.

Advantageously, when the DTM main channel, and consequently the DTM subchannels, extends from a sending node to a receiving node via one or more intermediate ~~nodes, the intermediate nodes merely needs to participate~~ in the management of and the allocation of time slots to the DTM main channel, whereas the definition of DTM subchannels may be managed end to end. Thus, DTM subchannel resolution merely needs to be provided at the

sending and receiving node without involving the intermediate nodes.

The possibility of not having to involve intermediate nodes in the management of a plurality of DTM subchannels all extending over the same network path provides a great advantage in significantly reducing the signaling requirements, especially when the number of intermediate nodes is large.

According to an embodiment of the invention, said DTM subchannels comprise one or more control channels. In a conventional DTM network, a node will typically have access to a control slot, which makes it possible for the node to send control messages to other nodes situated on the same link (such as a bus or a ring). However, any control signaling to nodes on another link is impossible without the participation of an intermediate node that has access to a control channel on said another link and therefore can handle the control signaling necessary on that link. Consequently, when managing a channel that is not confined to one link, but instead reaches over a plurality of links, a plurality of intermediate nodes will typically have to take part in the exchange of control messages on a hop by hop basis.

According to the invention, by setting up a DTM main channel reaching over a plurality of links, and by defining a DTM control channel within that DTM main channel, said DTM control channel will provide a direct signaling path to node situated on other links. Consequently, said DTM main channel may be regarded as a virtual link connecting all nodes that uses said main channel to send and/or receive control messages or payload data. However, any intermediate node that merely provides mapping of said DTM main channel without participating in the actual sending/receiving of data in said channel or in DTM subchannels thereof will not be involved in the management of channels within said main channel, i.e. the management of channels on said virtual link.

As is evident, the invention significantly reduces the amount of signaling needed within a DTM network.

According to another embodiment of the invention, channels received from one or more input bitstreams are mapped into respective DTM subchannels of said DTM main channel, at an "input end" of said DTM main channel. The respective DTM subchannels of said DTM main channel are then mapped into respective output channels of one or more output bitstreams at an "output end" of said DTM main channel. The invention thus provides means for multiplexing channels into larger channels on over large parts of a network.

Furthermore the division of DTM channels into DTM subchannels according to the invention may be used recursive. In other words, according to an alternative embodiment, a plurality of DTM subchannels are transferred within a DTM main channel, which in turn is transferred together with other DTM channels as part of a supra DTM main channel, and so on. The creation of "virtual link" in the form of DTM main channels according to the invention may thus be performed over a plurality of hierarchical link levels.

According to another embodiment of the invention, data transferred within said DTM main channel is encrypted as a whole, i.e. not subchannel by subchannel. As a result, it becomes more difficult for an unauthorized user to decrypt a DTM subchannel, and network security and integrity is therefore enhanced.

According to a third aspect of the invention, there is provided a method for handling communication channels in a DTM network, said method comprising the steps of: accessing, via a first interface, a first link of said DTM network; establishing a DTM channel from said first interface to one or more intended receivers, at least one thereof being situated on another link of said DTM network and being reached via at least one switch node of said network; defining a virtual link, the connectivity

thereof being defined by said intended receivers of said a DTM channel, and a virtual interface associated with said virtual link, said virtual interface being defined by the access to the set of time slots defining said a DTM channel on said first link; and establishing one or more DTM channels on said virtual link to one or more of said intended receivers.

This third aspect of the invention thus provides an advantageous way for a node of the network to handle the division of DTM main channels into DTM subchannels according to the first and second aspect of the invention.

By regarding a DTM main channel of the above mentioned kind as a separate, virtual interface, and by operating the node accordingly, use of the invention is easily implemented without having to design complicated separate software processes and/or memory functions dedicated for the management and resolution of DTM subchannels. Since virtual interfaces according to the invention may be used recursively, an increased depth of the subchannel division (i.e. the division of DTM subchannels into DTM subchannels into subchannels, and so on) handled in a preferable manner using one and the same software function, as described further below with reference to Fig. 4.

According to an embodiment of the latter aspect of the invention, said one or more DTM subchannels are divided into DTM control channels and DTM data channels, wherein control signaling for managing said DTM data channels on said virtual link are performed using said one or more DTM control channels. This provides a mechanism for transmitting control messages between nodes located on separate links transparent to intermediate nodes, as has been discussed above.

As is understood, the term "intended receivers" refers to those units (nodes) that are set to transmit or receive data (whether control signaling or payload data) using said DTM main channel or DTM subchannels thereof.

In other words, a node that merely provides mapping of a DTM main channel (and consequently of the DTM subchannels within said main channel) from one bitstream to another without actually being set to listen to or transmit data within said main channel, and not being concerned with any existing subchannel resolution, is not considered as an "intended receiver".

The use of a unicast DTM main channel, i.e. a point-to-point "tunnel" wherein one single node acts as entry point and one single other node acts as exit node, will probably be the most common use of the invention. In such a case, the virtual link formed by said DTM main channel will be a unicast link. However, in an alternative embodiment, a multi-access DTM main channel, i.e. a DTM main channel that is accessed and used by a plurality of nodes, will be equally advantageous. In the latter case, said virtual link formed by said multi-access DTM main channel consequently may be regarded as a multi-access link. Consequently, in the latter case, a node having access to the multi-access DTM tunnel may be provided to read data from, and/or to transmit data into, one or more of the DTM subchannels thereof, for example acting in similar to the function of an add-drop multiplexor in relation to the DTM subchannels of said DTM main cahnnel.

For definition, as referred to herein, a "DTM network" is a circuit switched time division multiplexed network of the kind wherein information is transferred between nodes of the network on bitstreams. Each bit-stream is divided into regularly recurrent, fixed size frames, so called "DTM frames", each comprising a number of fixed size time slots, said time slots being separated into control slots and data slots. Thus, at each given point in time, a time slot position of a DTM frame defines either a control slot or a data slot. Control slots are used for control signaling between nodes of the network, and data slots are used for the transfer of user data (sometimes often referred to as payload data). How-

ever, note that control slots and data slots are basically handled in the same way on link level. The only difference between the two is that they are simply used in two different ways by the nodes of the network.

Furthermore, in a DTM network, write access to the time slots of a DTM frame is distributed among nodes being attached to the bitstream carrying said DTM frame, each node typically having write access to a respective at least one control slot and a respective dynamically adjustable set of data slots within each recurrent frame. Moreover, having write access to a time slot position in a frame means having write access to said time slot position within each recurrent frame.

In a DTM network, a node will use the data slots it has write access to for establishing so called "DTM channels" by allocating one or more of said data slots to each respective DTM channel. Hence, as referred to herein, a DTM channel, whether a "main channel" or a "sub-channel", is defined by one or more time slots occupying the same time slot position within each DTM frame of the bitstream upon which said DTM channel is carried. However, if a DTM channel reaches, for example, over two bitstreams, the channel may of course be defined by a different set of time slot positions on the two bitstreams. Also, a DTM channel may be either a control channel or a data channel, depending on whether control or data slots that is allocated to said channel. Furthermore, a DTM channel may be unicast (point-to-point), multicast (point-to-multipoint), or broadcast.

As the demand for network capacity changes, DTM channels may be dynamically established, terminated, or modified, the latter by changing the number of time slots ~~allocated to a DTM channel. Also, the distribution of~~ write access to time slot among different nodes may be dynamically modified as different nodes develop different needs for control signaling and data transfer.

The above mentioned and other aspects and features of the invention, such as the use of a switch core memory shared by all switch ports and the use of a router memory shared by all channels accessed by the router means, will be more fully understood from the following description of embodiments thereof.

Brief Description of the Drawings

Exemplifying embodiments of the invention will now be described with reference to the accompanying drawings, wherein:

Fig. 1 schematically shows a DTM network being operated in accordance with an embodiment of the invention;

Figs. 2a-2c schematically show allocation of time slots to DTM channels on a bitstream according to prior art;

Figs. 2d-2e schematically show allocation of time slots to DTM channels on a bitstream according to an embodiment of the invention;

Fig. 3 is a block diagram schematically illustrating a node of the network in Fig. 1; and

Fig. 4 schematically shows a simplified view of the DTM network in Fig. 1.

Detailed Description of Preferred Embodiments

A circuit switched time division multiplexed network, operating according to a DTM (Dynamic synchronous Transfer Mode) protocol, will now be described with reference to Fig. 1. In Fig. 1, a DTM network NW comprises a plurality of nodes N1-N11 connected via four uni-directional bitstreams B1-B4. Typically, each one of said bitstreams B1-B4 will be used together with a respective bitstream (not shown) propagating in the opposite direction, thereby together forming a bi-directional link connecting all nodes attached thereto. Nodes N1-N4 are attached to bitstream B1, nodes N4-N7 are attached to

bitstream B2, nodes N6, N8, and N9 are attached to bit-stream B3, and nodes N9-N11 are attached to bitstream B4.

The nodes in Fig. 1 typically provide end users (not shown) with access to the network. However, the network also comprises nodes not providing end user with network access, for example by merely providing switching of data between different links of the network, such as the switch nodes N4, N6, and N9. Furthermore, one or more of said nodes may interconnect the DTM network NW with an external network (not shown) separate from the DTM network NW shown in Fig. 1, such as, for example, an Ethernet network.

The data transport structure used on the bitstreams B1-B4 in Fig. 1, using a bitstream B2 as an example, will now be described with reference to Figs. 2a-2e.

As shown in Fig. 2a, the bitstream B2 is divided into recurrent, essentially fixed sized frames, wherein the start of each frame is defined by a frame synchronization time slot F. As an example, each frame will have a duration of 125 µs.

As shown in Figs. 2b and 2c, each frame is divided into a number of fixed sized, typically 64 bit, time slots. If using said frame length of 125 µs, a time slot size of 64 bits, and a bit rate of 2 Gbps, the total number of time slots within each frame will be approximately 3900.

The time slots are generally divided into control slots C4-C7 and data slots D4-D7. The control slots are used for signaling between the nodes of the network, whereas the data slots are used for the transfer of payload data. At network start-up, each node connected to bitstream B2, is typically allocated at least one control slot. Furthermore, the data slots are divided among the nodes connected to the bitstream. Consequently, as illustrated in Fig. 2b, at network start-up, node N4 will have access to a control slot C4 and a set of data slots D4 within each frame of the bitstream, node N5 will have

access to a control slot C5 and a set of data slots D5 within each frame of the bitstream, and so on. The set of slots allocated to a node as control slot(s) and/or data slot(s) occupy the same slot position within each frame of the bitstream. Hence, in the example, the control slot C4 belonging to node N4 occupies the second time slot within each frame of the bitstream.

During network operation, each node may increase or decrease its access to slots, thereby re-distributing the access to data and/or control slots among the nodes. For example, a node having a low transfer capacity demand may give away its access to time slots to a node having a higher transfer capacity demand. Furthermore, the slots allocated to a node need not be consecutive slots, but may reside anywhere within the frame.

Also, note that each frame begins with said frame synchronization time slot, defining the frame rate on the bitstream, and ends with one or more guard band time slots G.

Having gained access to at least one control slot and a plurality of data slots, node N4, as an example, may establish DTM channels on the bitstream B2 by allocating a subset of said plurality of data slots to the said DTM channels, using the control slot C4 for sending control messages referring to the management of said DTM channels.

Fig. 2c illustrates the prior art situation wherein node N4, having access to its control slot C4 and its range of data slots D4 on bitstream B2, has established four channels CH1, CH2, CH3, and CH4.

In this example, it is assumed that channel CH4 is a DTM channel from node N4 to node N7, node N4 having allocated seven of its data slots within each frame on bitstream B2 thereto and having informed the receiving node N7, using the control slot C4, about the existence of channel CH4.

Also, by allocating time slots within each frame on bitstream B2 and by requesting switch node N6 to allocate a corresponding set of time slots on bitstream B3, node N4 has set-up a DTM channel CH1 to node N9, comprising four slots within each frame on bitstream B2.

Furthermore, having received channel establishment requests from node N1 and N2 on bitstream B1, node N4 has established DTM channels CH2 and CH3 on bitstream B2, said channel CH2 forming part of a multi-hop channel from node N1 to node N11 and said channel CH3 forming part of multi-hop channel from node N2 to node N10. As is understood, time slots for channels CH1, CH2, and CH3 are correspondingly allocated on bitstream B2, B3, and B4.

In Fig. 2c, as an example, the transfer capacity of channel CH4 is larger than the transfer capacity of channel CH1, since the number of time slots allocated to channel CH4 is larger than the number of time slots allocated to channel CH1. The time slots allocated to a DTM channel occupy the same time slot positions within each recurrent frame of the bitstream.

Fig. 2d illustrates the situation wherein node N4, having recognized the many channels established to/via node N7, has established, in addition to the previous mentioned channel CH4 to node N7, a DTM main channel CH10 from node N4 to node N7 via node N6. Hence, all traffic in time slots within the channel CH10 on bitstream B2 will be mapped by node N6 into a corresponding channel portion on bitstream B3 to reach node N9.

Within the DTM main channel CH10, three DTM subchannels CH11, CH12, and CH13, corresponding to the above-mentioned channels CH1, CH2, and CH3 in Fig. 2c, are defined. In similar to the channels in Fig 2c, each DTM subchannel is defined to comprise a respective set of slots within each bitstream frame. Furthermore, node N4 has turned one time slot within the channel (the first time slot of the channel within each frame) into a control slot C4v, using said control slot to transmit

control messages to node N9. Hence, node N4 now has access to one control slot C4 that is received by all nodes on link L3 and to one control slot C4 that is transferred within the main channel CH20 and is received by node N9.

As a result, when managing the allocation of time slots to channels within the main channel CH10, node N4 need no longer exchange control messages via control slot C4, using node N6 as an intermediary negotiator to reach node N9. Instead, node N4 is now able to transmit control messages to node N9 directly using the control slot C4v defined within said main channel CH10. Consequently, the main channel CH10 may be regarded as a virtual link providing a virtual direct connection between nodes N4 and N9. Similarly, the access, at node N4, to the slots defining said main channel CH 10 on bitstream B2 may be regarded as forming a virtual interface that provides access to said virtual link.

As an example, Fig. 2e shows the situation wherein the definition of DTM subchannels within the DTM main channel has been altered due to changes in capacity demands. In Fig. 2e, channel CH11 has been terminated, channel CH12 is unchanged, and the bandwidth of channel CH13 has been increased. However, the size and allocation of time slots to the main channel CH10 is unchanged. Consequently, as all necessary control signaling between nodes N4 and N9 has been performed using the control slot C4v, and as all changes referring to the allocation of time slots to channels on bitstreams L2 and L3 have taken place within the interior of main channel CH10, non of these changes has required the knowledge of or interaction with, for example, node N6.

~~The design of a node of the network in Fig. 1, using~~ node N4 as an example, will now be described with reference to Fig. 3.

The node 100 in Fig. 3, which in this example is assumed to be the node N4 in Fig. 1, comprises four 2-

ports interfaces 10, 20, 30, and 40, wherein the first and third interface 10 and 30 provides read/write access to the bitstreams B1 and B2, respectively, and the second and fourth interface 20 and 40 provides read/write access to respective unidirectional bitstreams (not shown in Fig. 1) propagating in opposite directions compared to said bitstreams B1 and B2.

The interfaces are all connected to a shared memory 50 that is used to provide time and space switching of data among the links connected to the node on a slot by slot basis. The shared memory 50 comprises frame buffers for each received bitstream. Thus, the bitstream frames received by, e.g., interface 10 is sequentially written into the shared memory 50 for temporary storage therein. Simultaneously, the bitstream frames received by interface 20 are sequentially written into another portion of the shared memory 50 for temporary storage therein, and so on.

Furthermore, each interface 10, 20, 30, and 40 comprises a respective slot mapping table 11, 21, 31, and 41 used when transmitting data into the respective bitstream. Each slot mapping table comprises one entry for each outgoing time slot of the respective outgoing bitstream frame to be transmitted, and each entry provides pointers stating from which position in the shared memory 50 to read data from for the respective outgoing time slot.

The content of the slot mapping tables is indirectly controlled by a node controller 60. The node controller 60 is arranged to read data from one or more positions of the shared memory 50, said position corresponding to control slots of other node's control channels, in order to receive control messages from other nodes. Likewise, the node controller 60 is arranged to write data into one or more positions of the shared memory 50, said position corresponding to control slots of the node's own control

channels to other nodes, in order to transmit control messages to other nodes.

When establishing a new channel, for example based upon a channel establishment request received from another node and consequently read from positions of the shared memory 50, the node controller may access a routing table 70 providing, among others, information as to which receivers that may be reached via each interface, said interface either being an actual interface (i.e. an interface 11, 21,...) or a virtual interface (as discussed above). Based upon such information, the node controller will set up a channel by providing an entry in a channel table 80 and by transmitting a channel announcement message to other nodes (by writing said channel announcement message into positions of the shared memory 50 corresponding to an outgoing control channel).

The channel table 80 provides a list of entries, one for each channel handled by the node N4. For each channel entry of the channel table 80, information is provided stating from which interface (actual or virtual), and corresponding time slot positions, data is to be received for the respective channel and which interface (actual or virtual), and corresponding time slot positions, that is to be used when transmitting data within said channel.

The channel table 80 is connected to an interface mapping unit 90 that provides mapping between virtual channels/slots and actual channels/slots. For example, the interface mapping unit will contain a table (not shown) stating, for example, that slots 2-20 of (virtual) interface 5 correspond to slots 12-30 of (actual) interface 1.

When using virtual interfaces in a recursive manner, ~~i.e. having a main channel encompassing a number of sub-~~channels, at least one thereof in turn also encompassing a number of sub-subchannels, and so on, the interface mapping table used by the interface mapping unit 90 will be provided with recursive mapping instructions, for

example by having one entry stating, that slots 2-4 of (virtual) interface 6 correspond to slots 6-8 of (virtual) interface 5, and another entry stating that slots 6-8 of (virtual) interface 5 correspond to slots 100-102 of (actual) interface 1.

If the establishment of a channel implies establishment of a virtual interface/link, as discussed above, the node controller will make sure that the channel table 80 and the interface mapping unit 90 are updated accordingly.

Using the interface mapping table, the interface mapping unit 90 will translate the channel list of channel table 80 and, based thereupon, see to that the necessary pointers of the slot mapping tables 11, 21, 31, and 41 are provided. Thus, the slot mapping tables will always be updated with correct mapping instructions.

Fig. 4 schematically shows a simplified view of the DTM network in Fig. 1. In Fig. 4, it is assumed that node N4, in similar to what has been described above has established a main channel CH30 to node N9 via node N6, said main channel comprising time slots 1, 2, 4, 5, 6, 9, 10, 11, and 12 within each frame of bitstream B2 and time slots 5, 6, 7, 8, 9, 10, 12, 13, and 14 within each frame of bitstream B3. Furthermore, using control signaling between nodes N4 and N9, it has been defined that, among this set of slots comprising 9 slots within each frame on both bitstreams, the first two slots are assigned to a subchannel CH31, the following two slots are assigned to a subchannel CH32, and the last four slots are assigned to a subchannel CH33, leaving the fifth slot in the set of slots unassigned.

Table I and II show an example of the content of the ~~channel table and interface mapping table provided in~~ node N4 at the situation described with reference to Fig. 4.

Table I - Interface Mapping Table

Outgoing Interface	Slots	Outgoing Interface	Slots
1	1-9	1	1,2,4,5,6,9,10,11,12

Table II - Channel Table

Channel	Outgoing Interface	Slots
CH30	1	1,2,4,5,6,9,10,11,12
CH31	2	1,2
CH32	2	3,4
CH33	2	5,6,7,8

As is evident from table I, node N4 now considers the channel formed by slots 1, 2, 4, 5, 6, 9, 10, 11, and 12 of interface 1 (in this case the actual interface to bitstream B2) as forming a virtual interface 2 offering slots 1-9 on that virtual interface.

Furthermore, channel CH31 is defined to comprise slots 1 and 2 of the (virtual) interface 2, which may be translated, using table I, into slots 1 and 2 of the actual interface 1. Correspondingly, channel CH32 is defined to comprise slots 3 and 4 of the (virtual) interface 2, which may be translated, using table I, into slots 4 and 5 of the actual interface 1.

Table III and IV show an example of the content of the channel table and interface mapping tables provided in node N6 at the same situation as described above.

Table III - Interface Mapping Table

Interface	Slots	Interface	Slots
-	-	-	-

Table IV - Channel Table

Channel	Incoming Interface	Slots	Outgoing Interface	Slots
CH 30	1	1,2,4,5,6, 9,10,11,12	2	5,6,7,8,9, 10,12,13,14

As is evident from table III, node N6 has not at this point defined any virtual interfaces. Furthermore, as seen in table IV, channel CH30 is defined to comprise slots 1, 2, 4, 5, 6, 9, 10, 11, and 12 of interface 1 (the actual interface to bitstream B2) and slots 5, 6, 7, 8, 9, 10, 12, 13, and 14 of interface 2 (the actual interface to bitstream B3). Hence, as is evident from tables I and II, node N6 is at this point unaware of the existence of subchannels within channel CH30.

Even though the invention has been described above with reference to exemplifying embodiments thereof, these are not to be considered as limiting the scope of the invention. Consequently, as understood by those skilled in the art, different modifications, combinations and alterations may be made within the scope of the invention, which is defined by the accompanying claims.

CLAIMS

1. A method for establishing communication channels in a DTM network, said method comprising the steps of:
   establishing a DTM channel (CH10) from a first node to a second node via one or more intermediate nodes; and
   establishing a set of DTM channels (CH11, CH12, CH13) within said a DTM channel.

2. A method as claimed in claim 1, wherein said set of DTM channels are established within said a DTM channel using control signaling between said first node and said second node, said one or more intermediate nodes not participating in said control signaling.

3. A method as claimed in claim 2, wherein said control signaling is performed within said a DTM channel.

4. A method as claimed in claim 1, 2 or 3, wherein management of said set of DTM channels is performed using one or more of the DTM channels (C4v) that form said set of DTM channels.

5. A method as claimed in any one of the preceding claims, wherein said a DTM channel is a unicast channel, said first and second node forming the end points thereof.

6. A method as claimed in any one of claims 1-4, wherein said a DTM channel is a multicast channel, extending beyond at least one of said first node and said second node.

7. A method as claimed in any one of the preceding claims, wherein said a DTM channel extends over a plurality of intermediate nodes.

8. A method as claimed in any on of the preceding claims, wherein one or more DTM channels among said set of DTM channels extend beyond an end point of said a DTM channel.

9. A method as claimed in any one of the preceding claims, wherein each one of said one or more intermediate nodes that provides switching of said a DTM channel between two bitstreams of said DTM network is arranged to provide slot to slot mapping between the sets of time slots that define said a DTM channel on said two bit-streams.

10. A method as claimed in any one of the preceding claims, wherein each one of said one or more intermediate nodes that provides switching of said a DTM channel from one bitstream to another bitstream of said DTM network participates in said step of establishing said a DTM channel by allocating a respective set of time slots to said a DTM channel on said another bitstream.

11. A method as claimed in any one of the preceding claims, comprising transferring a number of isochronous channels from one or more first bitstreams to one or more second bitstreams via said a DTM channel, each one of said isochronous channels being mapped into a respective DTM channel of said set of DTM channels.

12. A method as claimed in any one of the preceding claims, comprising encrypting the information transferred in said a DTM channel as a whole.

~~13. A method as claimed in any one of the preceding~~ claims, comprising dynamically changing the size of said a DTM channel.

14. A method as claimed in any one of the preceding claims, wherein the size of said a DTM channel is changed as a result of a change in the total capacity demand of said set of DTM channels.

15. An arrangement for establishing communication channels in a DTM network, said arrangement comprising:

a first node (N4; 100);

a second node (N9; 100);

means (60, 80) for establishing a DTM channel from said first node to said second node, wherein said DTM channel is established via one or more intermediate nodes; and

means for (60, 80, 90) establishing a set of DTM channels within said a DTM channel.

16. An arrangement as claimed in claim 15, wherein said set of DTM channels is established within said DTM channel using control signaling between said first node and said second node, said control signaling not involving said one or more intermediate nodes.

17. An arrangement as claimed in claim 16, wherein said control signaling is performed within said a DTM channel.

18. An arrangement as claimed in claim 15, 16, or 17, wherein management of said set of DTM channels is performed using one or more of the DTM channels that form said set of DTM channels.

19. An arrangement as claimed in claim 15, 16, 17, or 18, wherein said a DTM channel is a unicast channel, said first and second node forming the end points thereof.

20. An arrangement as claimed in claim 15, 16, 17, or 18, wherein said a DTM channel is a multicast channel, extending beyond at least one of said first node and said second node.

21. An arrangement as claimed in any one of claims 15-20, wherein said a DTM channel extends over a plurality of intermediate nodes (N5, N6, N8).

22. An arrangement as claimed in any on of claims 15-21, wherein one or more DTM channels among said set of DTM channels extend beyond an end point of said a DTM channel.

23. An arrangement as claimed in any one of claims 15-22, wherein each one (N6) of said one or more intermediate nodes that provides switching of said a DTM channel between two bitstreams of said DTM network is arranged to provide slot to slot mapping between the sets of time slots that define said a DTM channel on said two bitstreams.

24. An arrangement as claimed in any one of claims 15-23, wherein each one of said one (N6) or more intermediate nodes that provides switching of said a DTM channel from one bitstream to another bitstream of said DTM network is arranged to participate in said step of establishing said a DTM channel by allocating a respective set of time slots to said a DTM channel on said another bitstream.

25. An arrangement as claimed in any one of claims 15-24, wherein said means for establishing a set of DTM channels is arranged to map one or more isochronous channels, received at said first node, into respective DTM channels of said set of DTM channels.

26. An arrangement as claimed in any one of claims 15-25, wherein said means for establishing a set of DTM channels is arranged to map one or more of said set of DTM channels into respective isochronous channels transmitted from said second node.

27. An arrangement as claimed in any one of claims 15-26, wherein said means for establishing a DTM channel is arranged to dynamically changing the size of said a DTM channel.

28. An arrangement as claimed in any one of claims 15-27, wherein said means for establishing a DTM channel is arranged to change the size of said a DTM channel as a result of a change in the total capacity demand of said set of DTM channels.

29. A method for handling communication channels in a DTM network, said method comprising the steps of:

accessing, via a first interface, a first link of said DTM network;

establishing a DTM channel from said first interface to one or more intended receivers, at least one thereof being situated on another link of said DTM network and being reached via at least one switch node of said network;

defining a virtual link, the connectivity thereof being defined by said intended receivers of said a DTM channel, and a virtual interface associated with said virtual link, said virtual interface being defined by the access to the set of time slots defining said a DTM channel on said first link; and

establishing one or more DTM channels on said virtual link to one or more of said intended receivers.

30. A method as claimed in claim 29, comprising the step of dividing the data slots forming said a DTM channel into control slots and data slots.

31. A method as claimed in claim 29 or 30, wherein said one or more DTM channels comprises a DTM control channel used for managing said one or more DTM channels within said a DTM channel.

32. A method as claimed in claim 29, 30, or 31, comprising the steps of:

accessing, via a second interface, a second link of said DTM network;

receiving one or more DTM channels on said second link; and

mapping said one or more DTM channels received on said second link into respective DTM channels established on said virtual link.

ABSTRACT

The present invention relates to methods and an arrangement for establishing communication channels in a DTM network.

According to the invention a DTM channel is established from a first node (N4) to a second node (N9) via one or more intermediate nodes (N5, N6, N8). Furthermore, a set of DTM channels are established within said a DTM channel, typically using control signaling between said first node and said second node, said one or more intermediate nodes not participating in said control signaling.

Elected for publication: Fig. 1

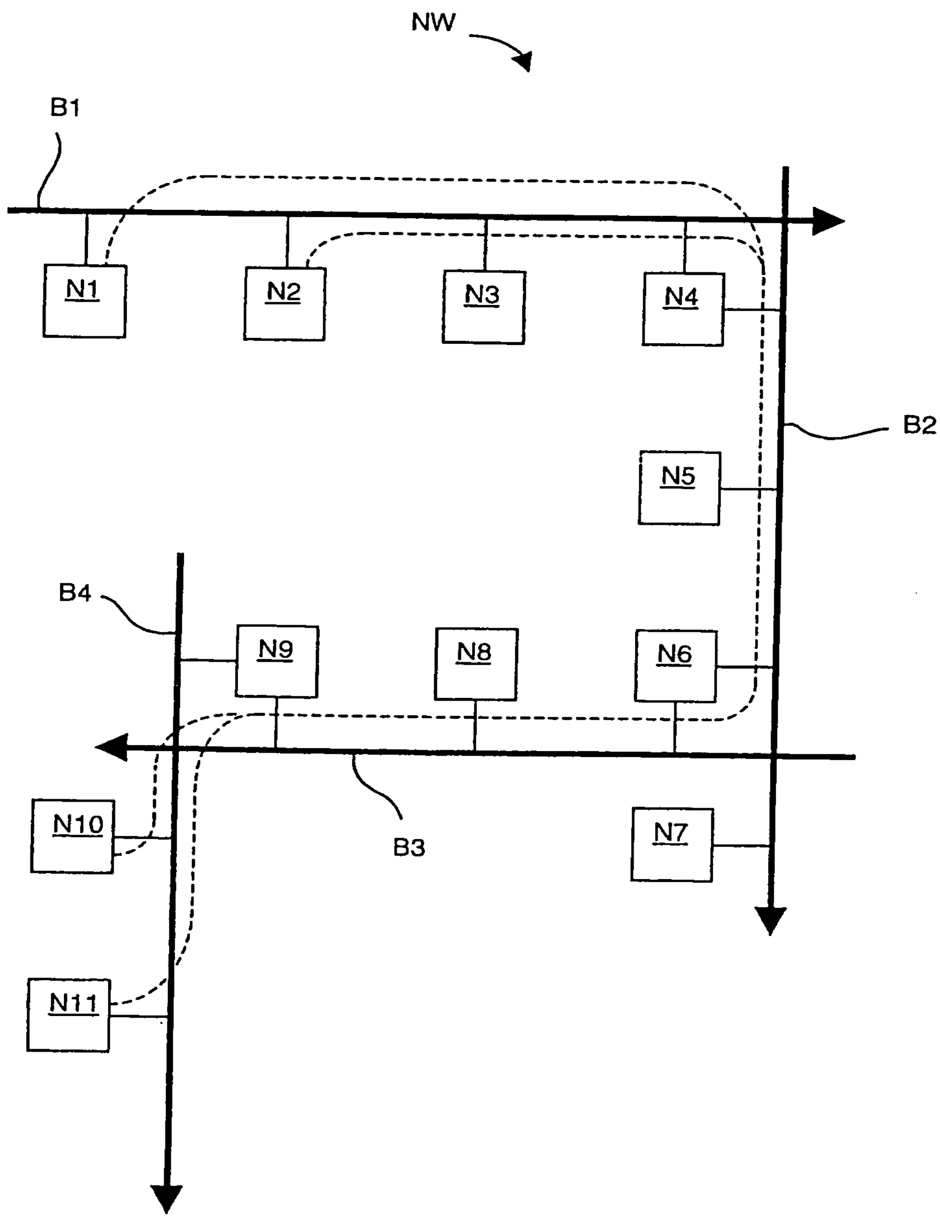
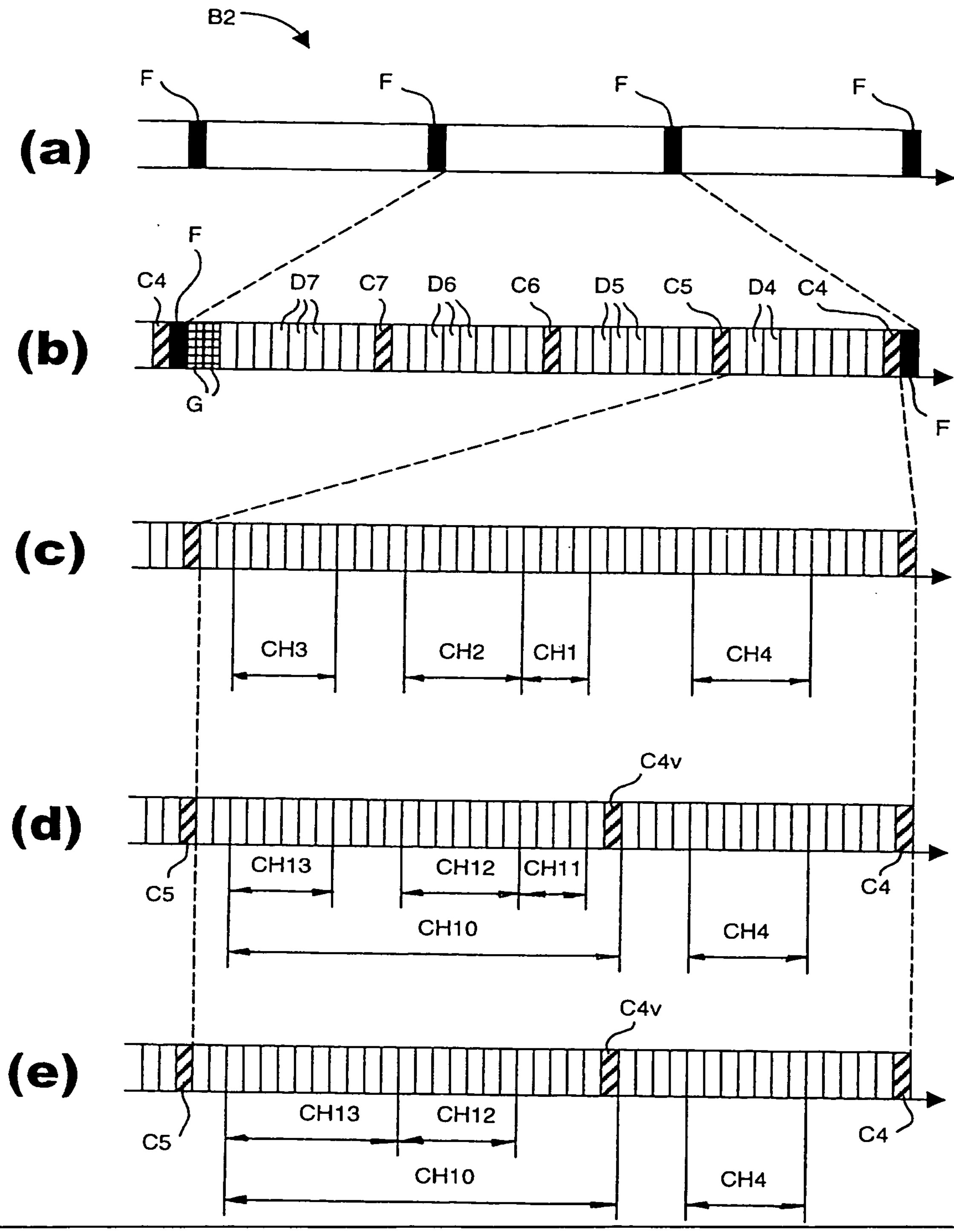


FIG. 1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F
F
F
F
(a)
F
C4
D7
C7
D6
C6
D5
C5
D4
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(b)
G
F
(c)
CH3
CH2
CH1
CH4
C4v
(d)
C5
CH13
CH12
CH11
C4
CH10
CH4
C4v
(e)
CH13
CH12
C5
C4
CH10
CH4

FIG. 2

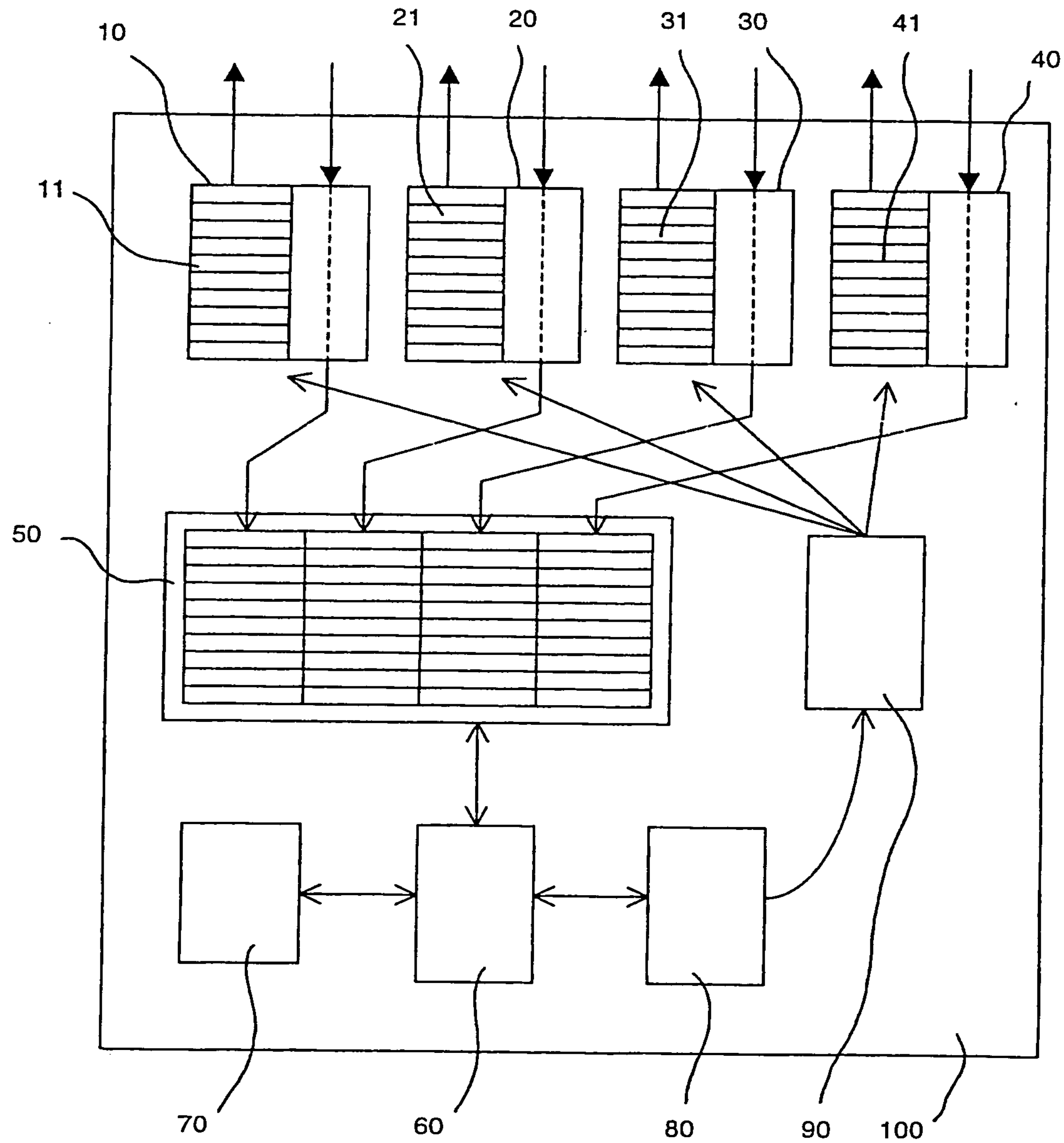
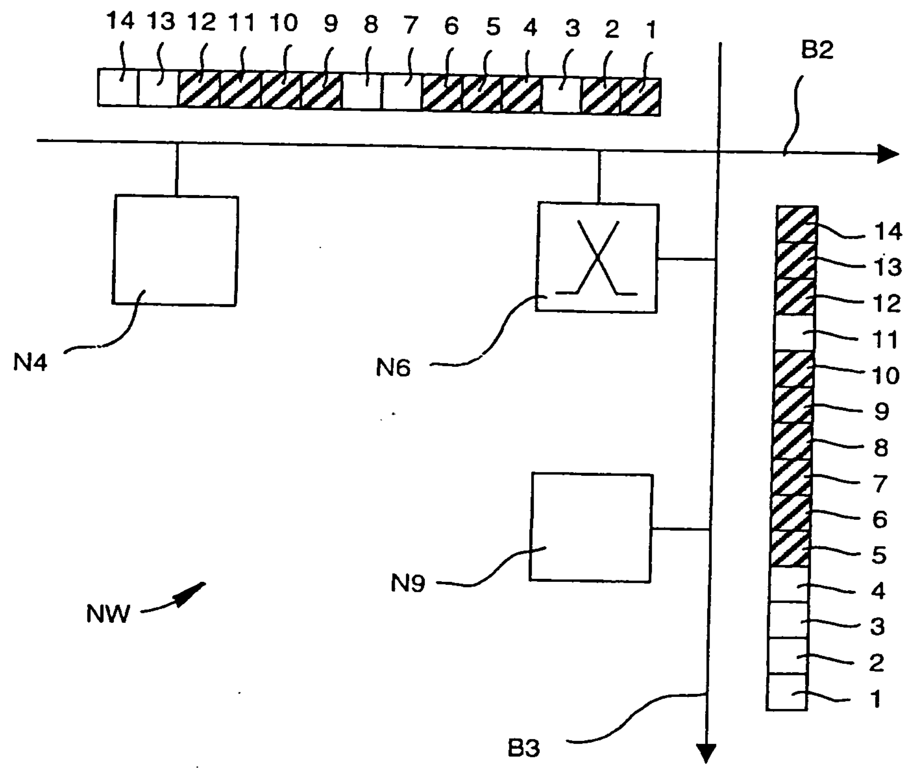


FIG. 3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B2
14
13
12
11
10
9
8
7
6
5
4
3
2
1
N4
N6
N9
NW
B3

FIG. 4

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